NEW MEXICO OZONE ATTAINMENT INITIATIVE

Photochemical Modeling Study

Assessment of the Ozone Impacts due to the Proposed Part 50 New Mexico Oil and Gas Ozone Precursor Control Strategy

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RAMBOLL Bright ideas. Sustainable change.

STEPS IN THE NM OAI PHOTOCHEMICAL MODELING STUDY
April 2020 – May 2021

01 Modeling Protocol

02 WRF Meteorological Modeling

03 2014 Base Case Emissions Based on WRAP 2014v2

04 CAMx 2014 Base Case Modeling Model Performance Evaluation

05 2028 New Mexico O&G Emissions Development

06 2028 Base Case Emissions Based on WRAP 2028 OTB12

07 CAMx 2028 Base Case

08 CAMx 2028 NM O&G Control Strategy

09 Assessment of Ozone Impacts of O&G Controls

10 2028 NM O&G Control Ozone Source Apportionment

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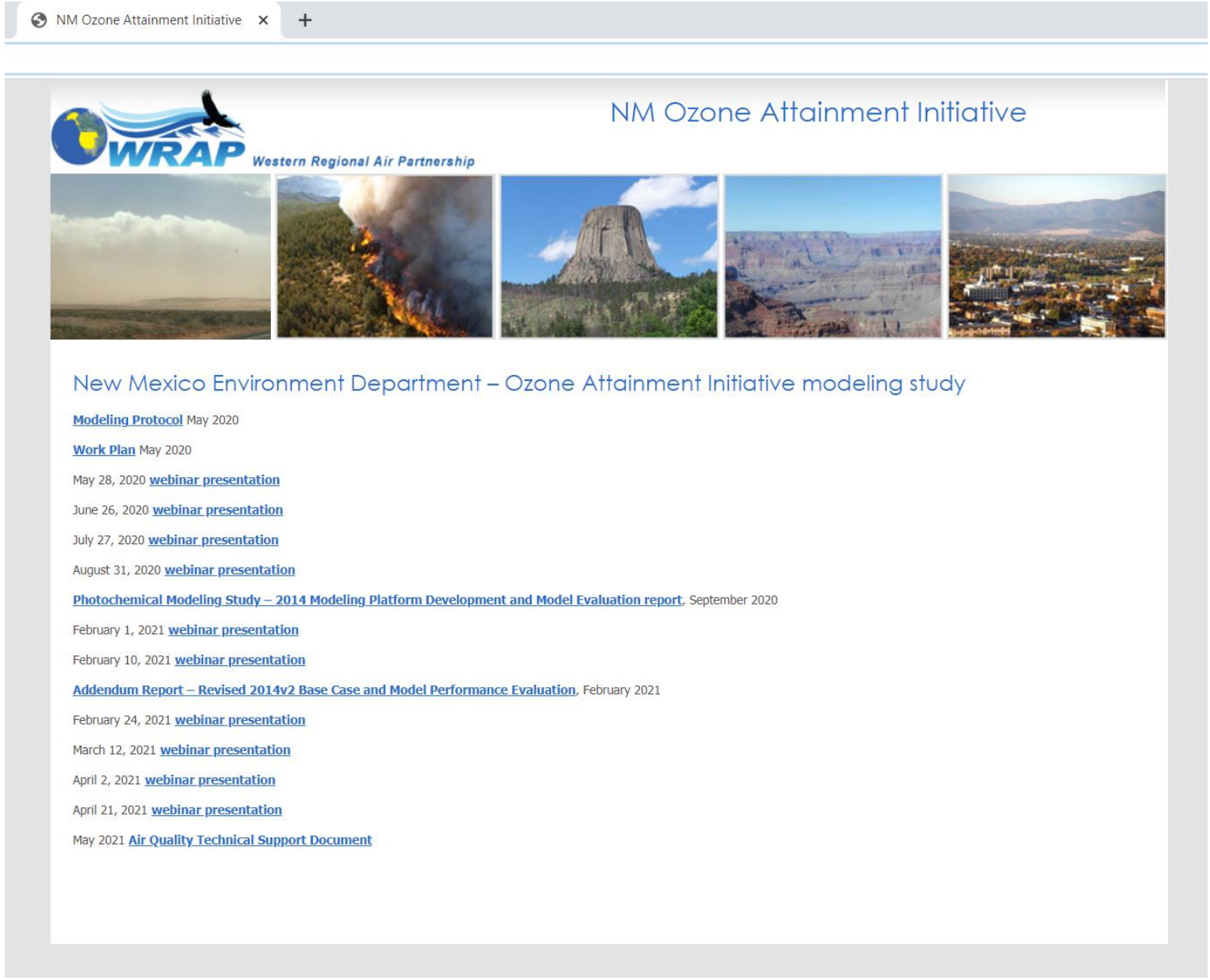
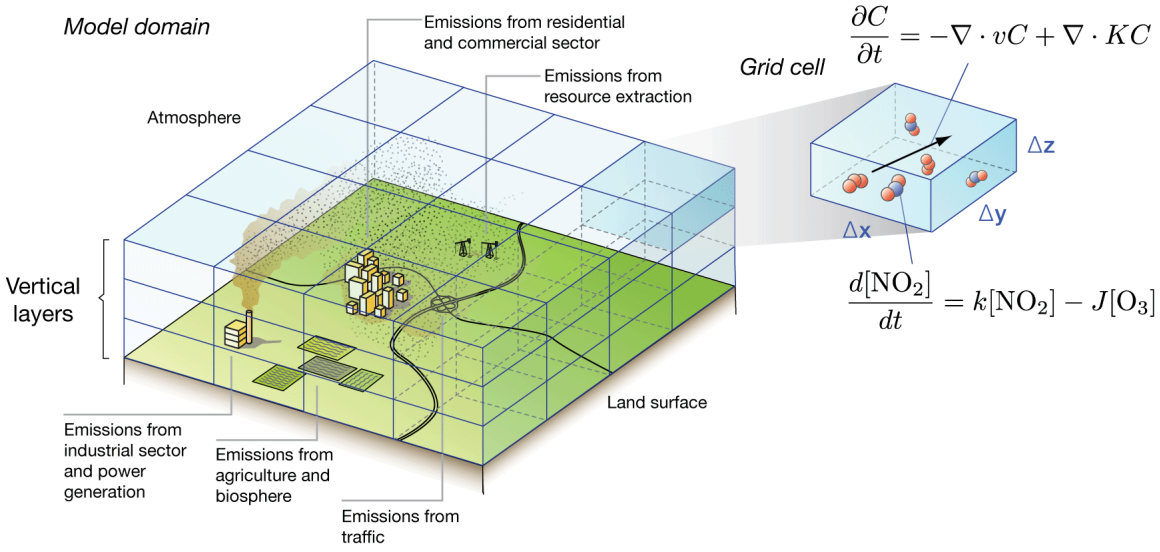
NM OAI MODELING WEBSITE

- http://wrapair2.org/NMOAI.aspx
- ~Monthly Webinars
  - Posted to Website
- Key Reports:
  - Modeling Protocol (May 2020)
  - 2014 Base Case (Sep 2020)
  - 2014v2 Base Case (Feb 2021)
  - Air Quality Technical Support Document (AQTSD) (May 2021)
- Direct Testimony based on AQTSD



COMPREHENSIVE AIR QUALITY MODEL WITH EXTENSIONS (CAMx) PHOTOCHEMICAL GRID MODEL (PGM)

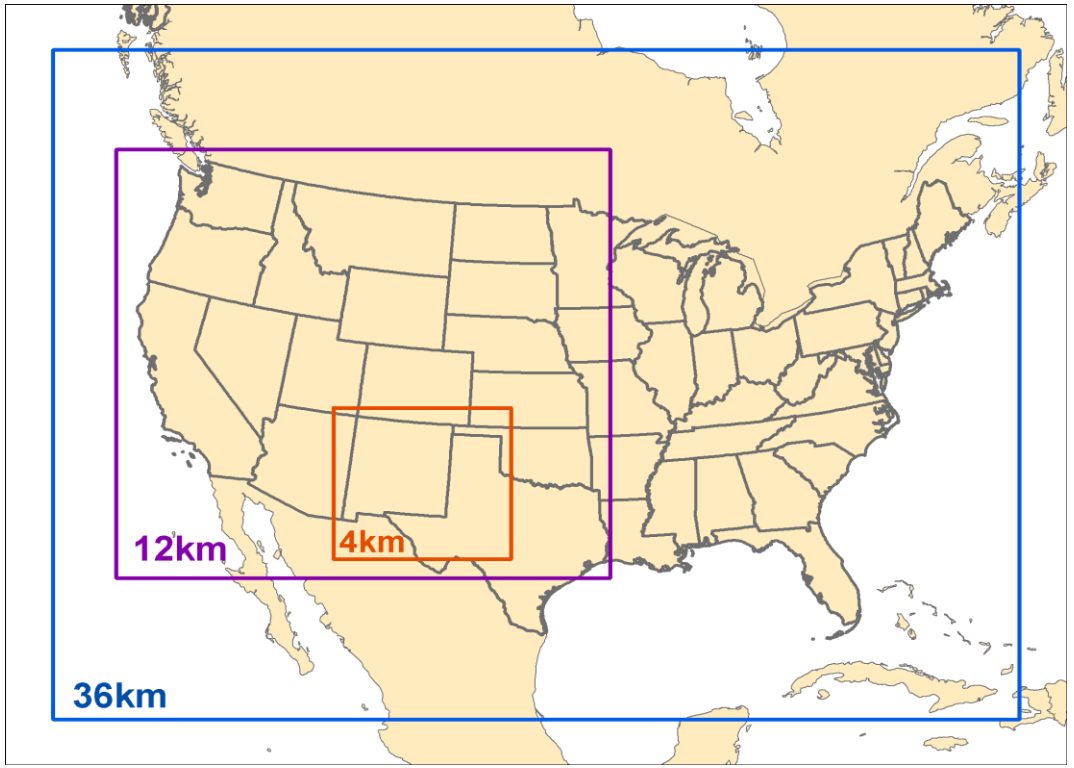
- PGM divides modeling domain into 3-D arrays of boxes (grid cells)
- Hourly 3-D meteorological inputs:
  - WRF meteorological model
- Boundary Condition (BC) concentrations along boundaries of domain represent transported pollutants
  - GEOS-Chem global chemistry model
- Low-level and elevated emission inputs
  - Hourly, gridded and speciated (SMOKE)
- CAMx PGM simulates transport, dispersion, chemical transformation and deposition



Source: AWMA Environmental Manager magazine, July 2012 issue on AQMEII, D. Steyn, P. Builtjes, M. Schaap and G. Yarwood

CAMx 2014 NM OAI STUDY MODEL CONFIGURATION

- Episode: May-August 2014 (4-Months)
  - 16-day spin-up before first high ozone day in NM
    - 68 ppb on May 17
- 36/12/4-km Modeling Domains (2-Way Nesting)
  - 36/12-km domains same as WRAP Regional Haze
  - New 4-km New Mexico domain
- Boundary Conditions (BC) from 2014 GEOS-Chem
- Four WRF Meteorological Diagnostic Sensitivity tests
  - Selected WRF/NAM with Kv=CMAQ
- WRAP 2014v2 base year emissions
  - EPA NEI2014v2 w/ western state updates
- WRAP 2028OTBa2 for future year with new 2028 New Mexico Oil and Gas Emissions



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CAMx 2014V2 BASE CASE MODEL PERFORMANCE EVALUATION

- Statistical evaluation compare against Ozone Performance Goals and Criteria (Emery et al., 2016)
  - Normalized Mean Bias (NMB) and Normalized Mean Error (NME)

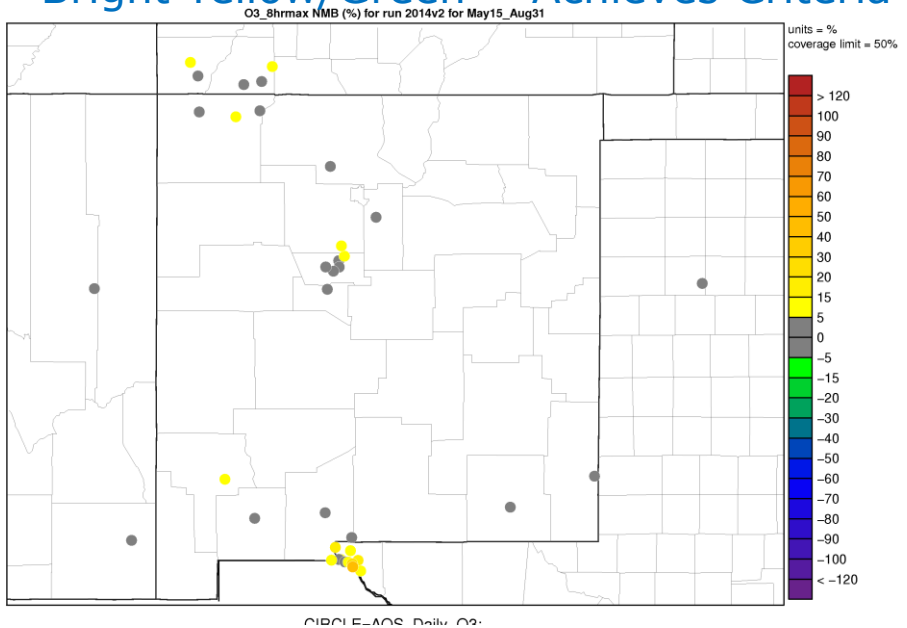
Species	NMB		NME	
	Goal	Criteria	Goal	Criteria
Ozone	<±5%	<±15%	<15%	<25%

- Evaluate across 3 subregions in New Mexico and at sites

	Nocutoff		Withcutoff	
Region	NMB(%)	NME(%)	NMB(%)	NME(%)
North NM	2.6	8.6	-1.0	6.6
Bernalillo	2.6	9.6	-4.3	8.5
South NM	3.5	10.2	-7.8	9.9

Normalized Mean Bias (NMB)

Grey = Achieves Performance Goal
Bright Yellow/Green = Achieves Criteria



- NMOGA modeling expert agreed with NM OAI AQTSD that the ozone model performance was as good or better than most PGM applications and appears to be a reliable PGM modelling platform for evaluating emissions reduction strategies in New Mexico (McNally Direct at p. 5)

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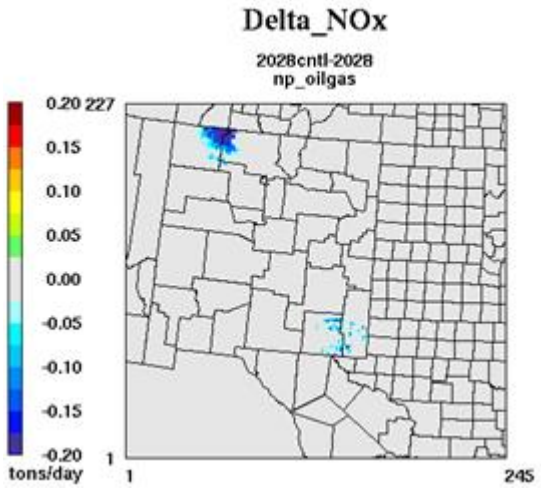
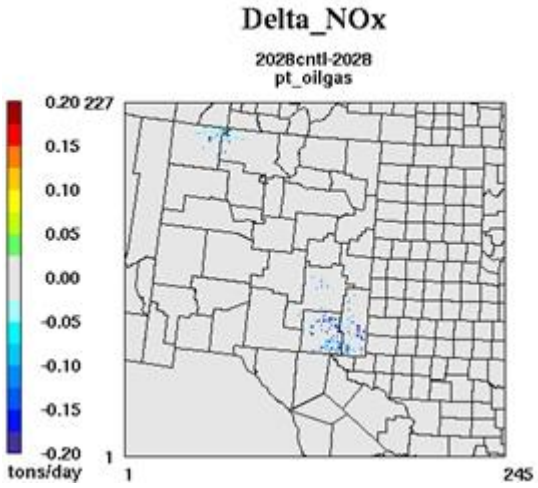
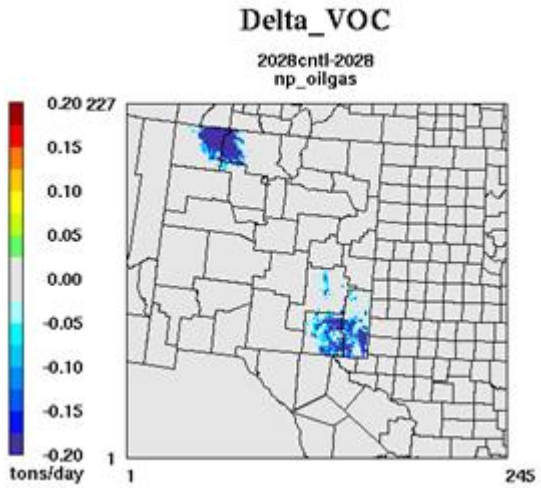
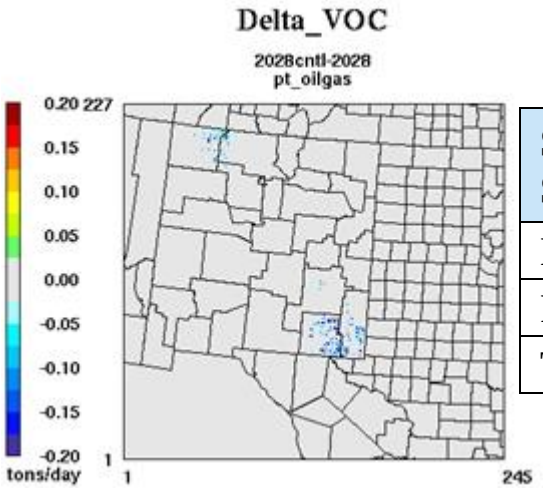
2028 BASE AND CONTROL NEW MEXICO O&G EMISSIONS









- 2028 Base Case New Mexico O&G Emissions
  - O&G projection factors based on circa 2028 NM O&G activity data provided by Bureau of Land Management (BLM) on September 15, 2020.
- 2028 Control Case New Mexico O&G Emissions
  - 2028 Base O&G Emissions provided to ERG who implemented Part 50 NM O&G controls
- WRAP 2028OTBa2 used for remainder of 2028 emissions

Source Sector	NO_x Emissions (TPY)			VOC Emissions (TPY)		
	Base	Control	Diff	Base	Control	Diff
Non-Point	61,245	33,144	-46%	181,252	85,564	-53%
Point	41,066	22,872	-44%	30,340	19,608	-35%
Total	102,311	56,016	-45%	211,592	105,172	-50%

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EPA GUIDANCE (2018) RECOMMENDED DEFAULT OZONE DESIGN VALUE PROJECTION PROCEDURES

- Ozone Design Value (DV) is defined as 3-year average of 4th highest Maximum Daily Average 8-hour (MDA8) ozone concentrations (used to define attainment of the NAAQS)
- EPA recommends using the 2014 and 2028 CAMx results in a relative fashion to scale the observed current year ozone DVC to obtain a projected future year 2028 ozone DVF
  - The model derived scaling factors are called Relative Response Factors (RRFs) and are the ratio of the 2028 to 2014 MDA8 ozone modeling results near the monitor averaged over the 10 highest MDA8 ozone days in the 2014 base case:

$$RRF = \sum \text{Model MDA8 Ozone}_{2028} / \sum \text{Model MDA8 Ozone}_{2014}$$

$$DVF = DVC \times RRF$$

  - EPA recommended default projection approach is to base the current year ozone DVC on the average of DVs across 5-years centered on the base modeling year, which is 2014 in this case:

$$DVC_{2012\text{-}2016} = (DV_{2012\text{-}2014} + DV_{2013\text{-}2015} + DV_{2014\text{-}2016}) / 3$$

- 2028 ozone projections made using EPA's Software for the Modeled Attainment Test (SMAT)

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EPA DEFAULT 2028 BASE CASE OZONE DVF PROJECTIONS

- Two sites with observed $DVC_{2012-2016}$ above the 70 ppb 2015 ozone NAAQS both in Dona Ana County:
  - 72.0 ppb at Desert View
  - 71.3 ppb at Santa Teresa
- 2028 base case ozone DVF projections all sites are below the 2015 ozone NAAQS using EPA guidance default projection approach:
  - Highest 2028 base case ozone DVF is 67.0 ppb at Desert View that is 95% of the NAAQS
  - Ozone DVF reductions of -2.0 ppb (Hobbs) to -6.3 ppb (La Union)

AQS_ID	2012-2016 DVC (ppb)	2028 Base DVF Base (ppb)	Difference 2028 DVF minus $DVC_{2012-16}$ (ppb)	Site Name	State	County
Northern New Mexico						
350390026	64.0	60.8	-3.2	Coyote Ranger District	NM	Rio Arriba
350431001	64.0	58.4	-5.6	Bernalillo (E Avenida)	NM	Sandoval
350450009	64.3	61.0	-3.3	Bloomfield	NM	San Juan
350450018	67.0	64.8	-2.2	Navajo Lake	NM	San Juan
350451005	63.7	60.8	-2.9	Substation	NM	San Juan
350490021	64.3	60.6	-3.7	Santa Fe Airport	NM	Santa Fe
Bernalillo County						
350010023	66.3	60.9	-5.4	Del Norte HS	NM	Bernalillo
350010024	68.0	62.3	-5.7	South East Heights	NM	Bernalillo
350010029	66.0	61.0	-5.0	South Valley	NM	Bernalillo
350010032	67.0	62.6	-4.4	Westside	NM	Bernalillo
350011012	65.0	59.1	-5.9	Foothills	NM	Bernalillo
Southern New Mexico						
350130008	66.3	60.0	-6.3	La Union	NM	Doña Ana
350130017	67.0	61.9	-5.1	Sunland Park City Yard	NM	Doña Ana
350130020	67.0	62.3	-4.7	Chaparral	NM	Doña Ana
350130021	72.0	67.0	-5.0	Desert View	NM	Doña Ana
350130022	71.3	66.1	-5.2	Santa Teresa	NM	Doña Ana
350130023	65.0	60.3	-4.7	Solano	NM	Doña Ana
350151005	69.0	66.7	-2.3	Carlsbad	NM	Eddy
350171003	62.0	59.0	-3.0	Chino Copper Smelter	NM	Grant
350250008	66.0	64.0	-2.0	Hobbs Jefferson	NM	Lea
350290003	66.0	62.7	-3.3	Deming Airport	NM	Luna
350610008	66.3	62.2	-4.1	Los Lunas (Los Lentes)	NM	Valencia

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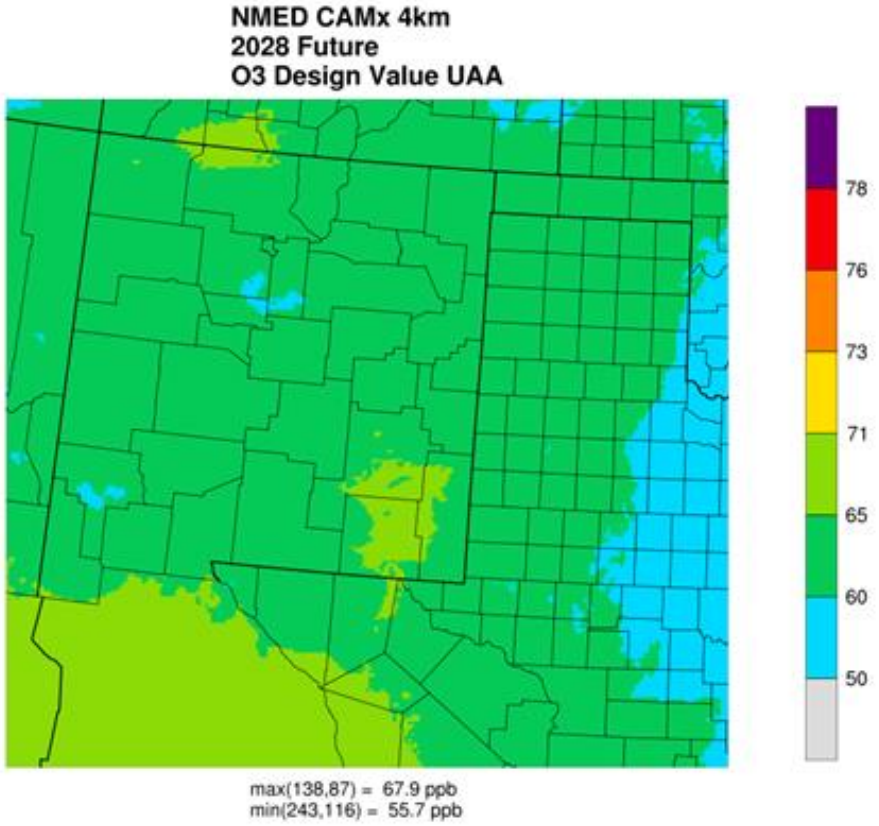
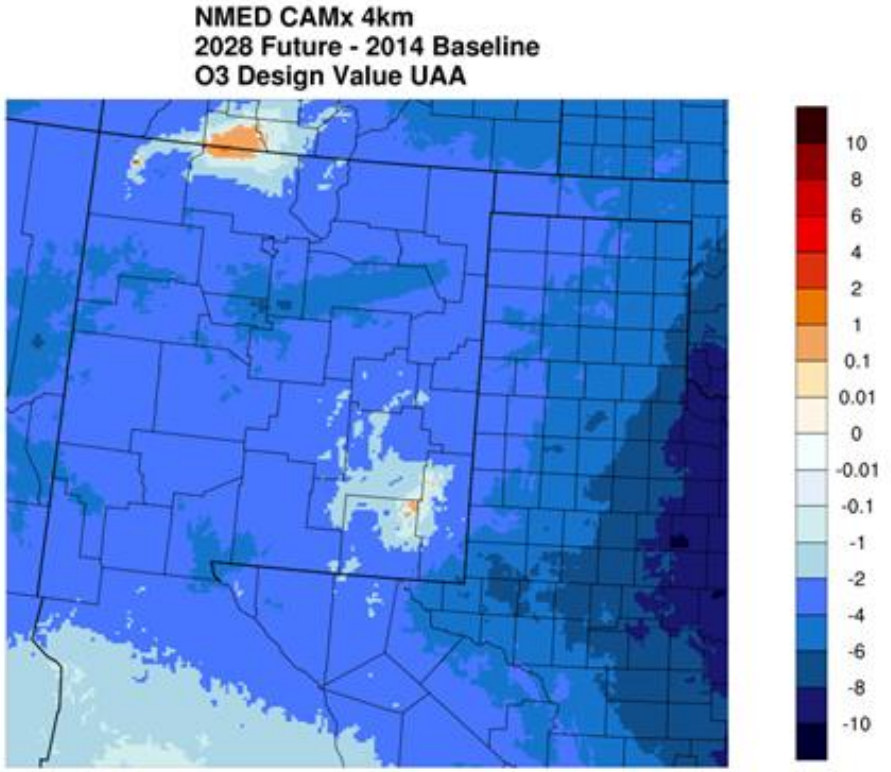
2028 BASE CASE OZONE DVF PROJECTIONS UNMONITORED AREA ANALYSIS USING EPA DEFAULT ($DVC_{2012-2016}$)

- 2028 Base Ozone DVF Projections
  - Maximum = 67.9 ppb



- 2028 - 2014 Differences in Ozone DVs
  - DVF – $DVC_{2012-2016}$



2028 O&G CONTROL STRATEGY OZONE DVF PROJECTIONS USING EPA DEFAULT APPROACH

- 2028 New Mexico O&G Control Strategy reduces 2028 base case ozone DVFs by -1.5 ppb to -0.1 ppb.
- Largest reductions in San Juan and Permian O&G Basins:
  - -1.5 ppb @ Navajo Lake (SJB)
  - -1.2 ppb @ Substation (SJB)
  - -0.8 ppb @ Bloomfield (SJB)
  - -0.7 ppb @ Hobbs (PB)
  - -0.3 ppb @ Carlsbad (PB)

AQS_ID	2012-16	Projected 2028 DVF			Site Name	State	County
	DVC (ppb)	Base (ppb)	Cntl (ppb)	Cntl - Base			
Northern New Mexico							
350390026	64.0	60.8	60.0	-0.8	Coyote Ranger District	NM	Rio Arrib
350431001	64.0	58.4	58.1	-0.3	Bernalillo (E Avenida)	NM	Sandoval
350450009	64.3	61.0	60.2	-0.8	Bloomfield	NM	San Juan
350450018	67.0	64.8	63.3	-1.5	Navajo Lake	NM	San Juan
350451005	63.7	60.8	59.6	-1.2	Substation	NM	San Juan
350490021	64.3	60.6	60.4	-0.2	Santa Fe Airport	NM	Santa Fe
Bernalillo County							
350010023	66.3	60.9	60.7	-0.2	Del Norte HS	NM	Bernalillo
350010024	68.0	62.3	62.0	-0.3	South East Heights	NM	Bernalillo
350010029	66.0	61.0	60.5	-0.5	South Valley	NM	Bernalillo
350010032	67.0	62.6	62.1	-0.5	Westside	NM	Bernalillo
350011012	65.0	59.1	58.8	-0.3	Foothills	NM	Bernalillo
Southern New Mexico							
350130008	66.3	60.0	59.8	-0.2	La Union	NM	Doña Ana
350130017	67.0	61.9	61.8	-0.1	Sunland Park City Yard	NM	Doña Ana
350130020	67.0	62.3	62.2	-0.1	Chaparral	NM	Doña Ana
350130021	72.0	67.0	66.8	-0.2	Desert View	NM	Doña Ana
350130022	71.3	66.1	66.0	-0.1	Santa Teresa	NM	Doña Ana
350130023	65.0	60.3	60.2	-0.1	Solano	NM	Doña Ana
350151005	69.0	66.7	66.4	-0.3	Carlsbad	NM	Eddy
350171003	62.0	59.0	58.9	-0.1	Chino Copper Smelter	NM	Grant
350250008	66.0	64.0	63.3	-0.7	Hobbs Jefferson	NM	Lea
350290003	66.0	62.7	62.5	-0.2	Deming Airport	NM	Luna
350610008	66.3	62.2	62.0	-0.2	Los Lunas (Los Lentes)	NM	Valencia

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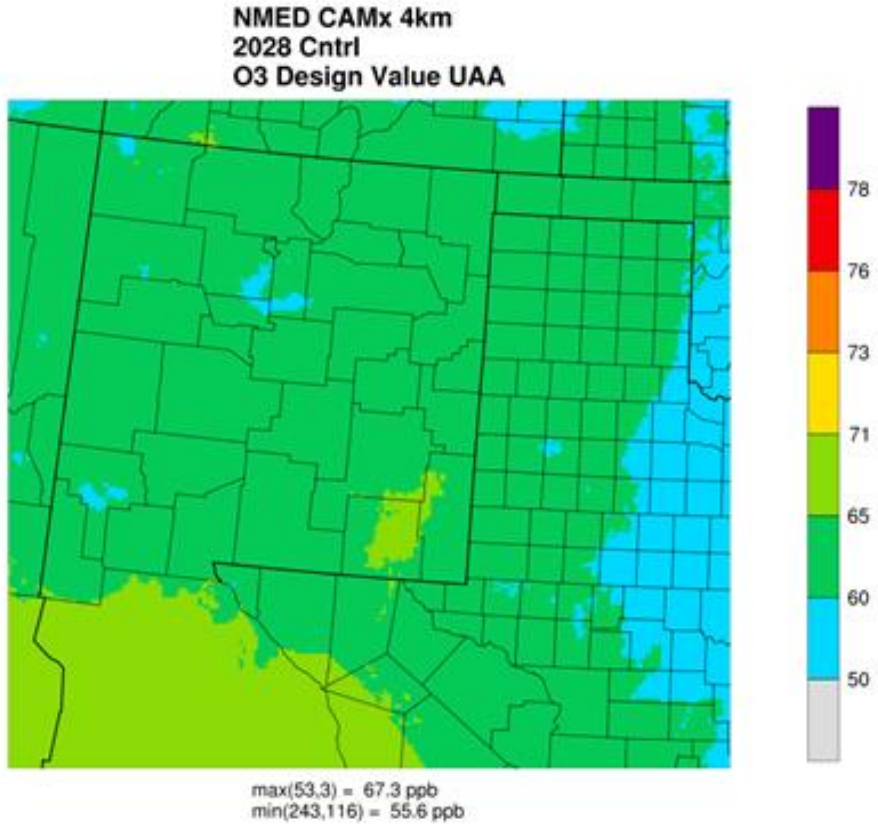
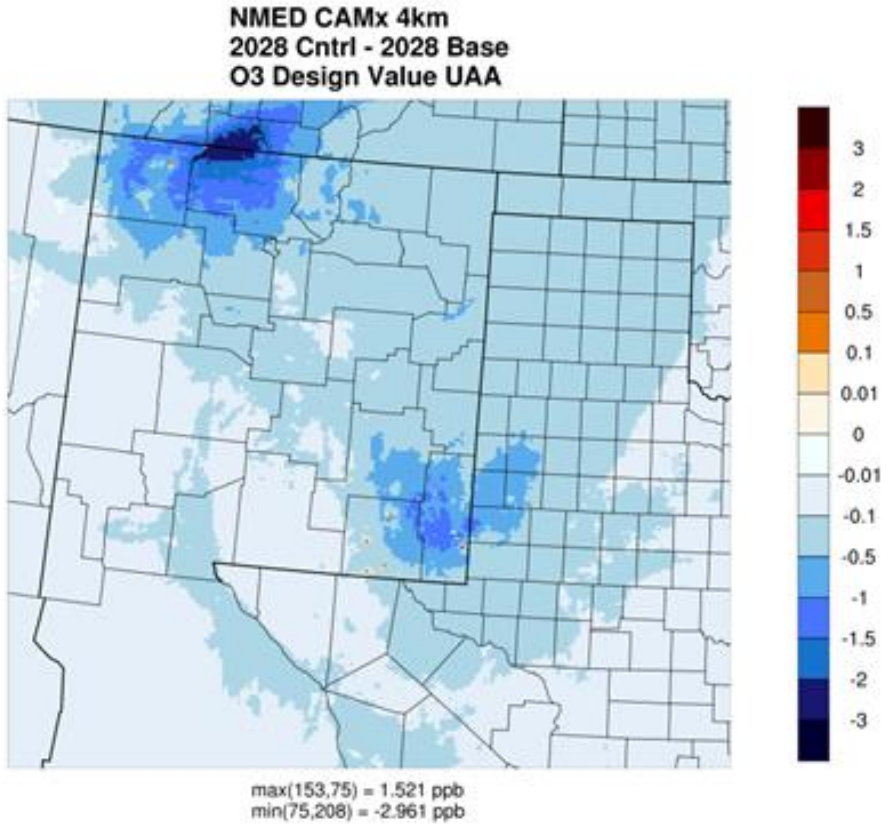
2028 O&G CONTROL STRATEGY OZONE DVF PROJECTIONS UNMONITORED AREA ANALYSIS EPA DEFAULT ($DVC_{2012-2016}$)

- 2028 Control Ozone DVF Projections
  - Maximum = 67.3 ppb

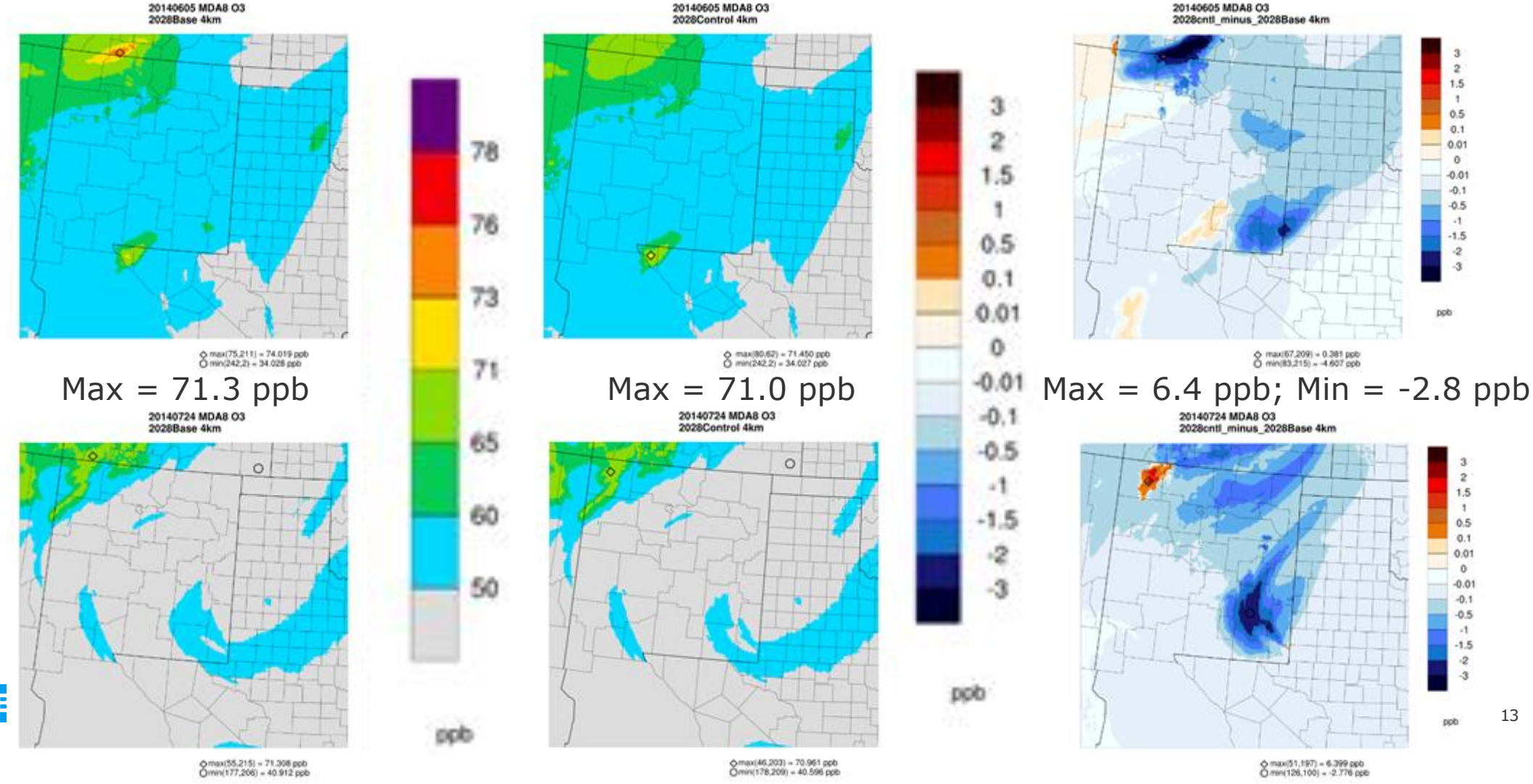


- 2028 Base - Control Differences in DVFs
  - 2028 DVF_{Cntl} – 2028 DVF_{Base}
  - Max = 1.5 ppb; Min = -3.0 ppb



EXAMPLE DAILY MDA8 OZONE RESULTS 2028 BASE & CONTROL

	2028 Base Case	2028 Control Case	2028 Control – 2028 Base
June 4, 2014	Max = 74.0 ppb	Max = 71.5 ppb	Max = 0.4 ppb; Min = -4.6 ppb
July 24, 2014	Max = 71.3 ppb	Max = 71.0 ppb	Max = 6.4 ppb; Min = -2.8 ppb



SENSITIVITY OF 2028 OZONE DVF PROJECTION TO DVC

- Ozone DVs have been increasing in Southern New Mexico since 2012-2016
  - 2012-2014 DV:
    - 3 sites > 2015 70 ppb ozone NAAQS
    - 14 sites > 95% 2015 ozone NAAQS
  - 2017-2019 DV:
    - 3 sites > 2008 75 ppb ozone NAAQS
    - 6 sites > 2015 70 ppb ozone NAAQS
    - 16 sites > 95% 2015 ozone NAAQS
- EPA modeling guidance suggests making FY ozone DVF projections using alternatives to EPA default approach
  - Use of alternative to base year DVC to EPA default ($DVC_{2012\text{-}2016}$) explicitly mentioned in EPA modeling guidance

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New Mexico Ozone DVs 2010 – 2019

Red > 75 ppb 2008 NAAQS
Yellow > 70 ppb 2015 NAAQS
Green > 95% of the 2015 ozone NAAQS

AQS Site ID	Local Site Name	County Name	2008-2010	2009-2011	2010-2012	2011-2013	2012-2014	2013-2015	2014-2016	2015-2017	2016-2018	2017-2019
350010023	Del Norte HS	Bernalillo	0.064	0.066	0.068	0.070	0.068	0.066	0.065	0.067	0.070	0.070
350010024	SE Heights	Bernalillo	0.066	0.068	0.070	0.070	0.068					
350010027	Westside	Bernalillo	0.067	0.068	0.071	0.071						
350010029	South Valley	Bernalillo	0.066	0.067	0.069	0.070	0.067	0.066	0.065	0.065	0.066	0.067
350010032	Westside	Bernalillo			0.070	0.070	0.067					
350011012	Foothills	Bernalillo	0.068	0.070	0.074	0.072	0.067	0.064	0.064	0.067	0.069	0.071
350011013	North Valley	Bernalillo	0.067	0.068	0.069	0.069						
350130008	La Union	Doña Ana	0.064	0.062	0.065	0.067	0.067	0.066	0.066	0.068	0.068	0.070
350130017	Sunland Park	Doña Ana	0.064	0.065	0.068	0.067	0.067					
350130020	Chaparral	Doña Ana	0.066	0.067	0.067	0.069	0.068	0.067	0.066	0.068	0.071	0.073
350130021	Desert View	Doña Ana	0.070	0.069	0.072	0.072	0.072	0.072	0.072	0.072	0.074	0.077
350130022	Santa Teresa	Doña Ana	0.067	0.066	0.070	0.075	0.074	0.072	0.068	0.072	0.074	0.076
350130023	Solano	Doña Ana	0.063	0.063	0.065	0.065	0.065	0.065	0.065	0.066	0.067	0.070
350151005	Carlsbad City	Eddy	0.067	0.068	0.071	0.071	0.071	0.069	0.067	0.068	0.074	0.079
350153001	Carlsbad Caverns	Eddy									0.071	
350171003	Chino Copper	Grant	0.063	0.065	0.067	0.063	0.062					
350250008	Hobbs Jefferson	Lea	0.059	0.061	0.061	0.066	0.065	0.067	0.066	0.067	0.070	0.071
350290003	Deming Airport	Luna	0.057	0.058	0.064	0.067	0.066					
350390026	Coyote Ranger District	Rio Arriba							0.064	0.065	0.067	0.067
350431001	Bernalillo	Sandoval	0.060	0.061	0.061	0.063	0.063	0.065	0.064	0.065	0.068	0.068
350439004	Pueblo of Jemez	Sandoval		0.062								
350450009	Bloomfield	San Juan	0.060	0.061	0.067	0.068	0.067	0.064	0.062	0.064	0.069	0.068
350450018	Navajo Lake	San Juan			0.071	0.071	0.068	0.067	0.066	0.068	0.070	0.069
350451005	Substation	San Juan	0.063	0.063	0.067	0.068	0.066	0.063	0.062	0.064	0.069	0.069
350490021	Santa Fe Airport	Santa Fe	0.063	0.062	0.065	0.066	0.066	0.064	0.063	0.063	0.066	0.066
350610008	Los Lunas	Valencia			0.067	0.070	0.069	0.066	0.064	0.065	0.067	0.068

2028 OZONE DVF PROJECTION SENSITIVITY ANALYSIS TO BASE YEAR DVC USING 2015-2019 OZONE ($DVC_{2015\text{-}2019}$)

- Alternative $DVC_{2015\text{-}2019}$ higher than EPA default $DVC_{2012\text{-}2016}$
  - 4 sites above 70 ppb NAAQS compared with 2 for $DVC_{2012\text{-}2016}$
  - For Desert View:
    - $DVC_{2012\text{-}2016}$ = 72.0 ppb
    - $DVC_{2015\text{-}2019}$ = 74.3 ppb
  - For Carlsbad:
    - $DVC_{2012\text{-}2016}$ = 69.0 ppb
    - $DVC_{2015\text{-}2019}$ = 73.7 ppb
- Carlsbad 2028 Base Case DVF (71.2 ppb) is above the 2015 ozone NAAQS
  - Under 2028 NM O&G Control Strategy it is below the 2015 ozone NAAQS (70.9 ppb)
- Many more uncertainties and caveats in $DVC_{2015\text{-}2019}$ sensitivity analysis

2015-19	Projected 2028 DVF			Site Name	County
DVC (ppb)	Base (ppb)	Cntl (ppb)	Cntl - Base		
69.0	63.4	63.1	-0.3	Del Norte HS	Bernalillo
66.0	61.0	60.5	-0.5	South Valley	Bernalillo
69.0	62.7	62.4	-0.3	Foothills	Bernalillo
68.7	62.1	62.0	-0.1	La Union	Doña Ana
70.7	65.7	65.7	0.0	Chaparral	Doña Ana
74.3	69.1	68.9	-0.2	Desert View	Doña Ana
74.0	68.6	68.5	-0.1	Santa Teresa	Doña Ana
67.7	62.9	62.7	-0.2	Solano	Doña Ana
73.7	71.2	70.9	-0.3	Carlsbad	Eddy
71.0	69.3	69.3	0.0	Carlsbad Caverns NP	Eddy
69.3	67.2	66.5	-0.7	Hobbs Jefferson	Lea
66.3	63.0	62.2	-0.8	Coyote Ranger Dist	Rio Arriba
67.0	61.2	60.9	-0.3	Bernalillo (E Avenida)	Sandoval
67.0	63.6	62.8	-0.8	Bloomfield	San Juan
69.0	66.7	65.2	-1.5	Navajo Lake	San Juan
67.3	64.2	62.9	-1.3	Substation	San Juan
65.0	61.2	61.0	-0.2	Santa Fe Airport	Santa Fe
66.7	62.6	62.3	-0.3	Los Lunas (Los Lentes)	Valencia

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OZONE SOURCE APPORTIONMENT MODELING USING 2028 NEW MEXICO O&G CONTROL STRATEGY EMISSIONS SCENARIO

- **CAMx 2028 O&G Control APCA Source Sector Ozone Source Apportionment Modeling**
- Separate ozone contributions from 9 New Mexico Source Sectors:
  - Natural Emissions
  - Fires
  - O&G Point
  - O&G Non-Point
  - Electrical Generating Units (EGU)
  - Non-EGU Point
  - On-Road Mobile
  - Non-Road Mobile
  - Other Anthropogenic

- **CAMx 2028 O&G Control OSAT VOC/NOx Sensitive Ozone Formation**
- Provides measure of whether ozone formation in New Mexico is more sensitive to VOC or NOx emissions
  - Use Percent NOx Sensitive Ozone formation Metric (%NOxSens) to display results
    - %VOCSens = 100 - %NOXSens

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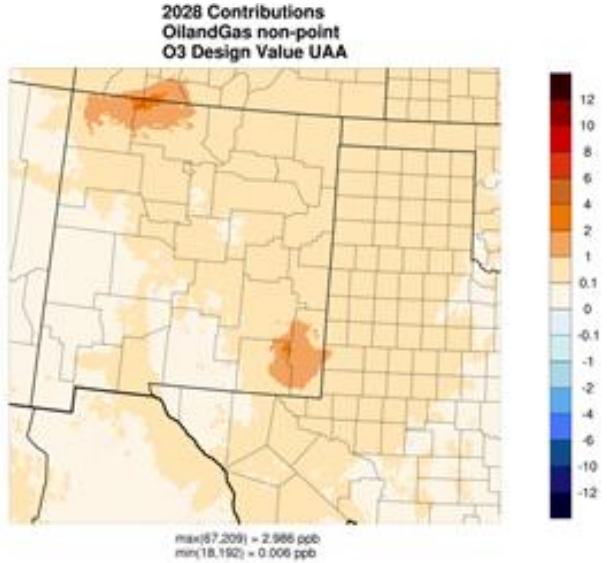
APCA CONTRIBUTION 2028 OZONE DVF -- 2028 O&G CONTROL

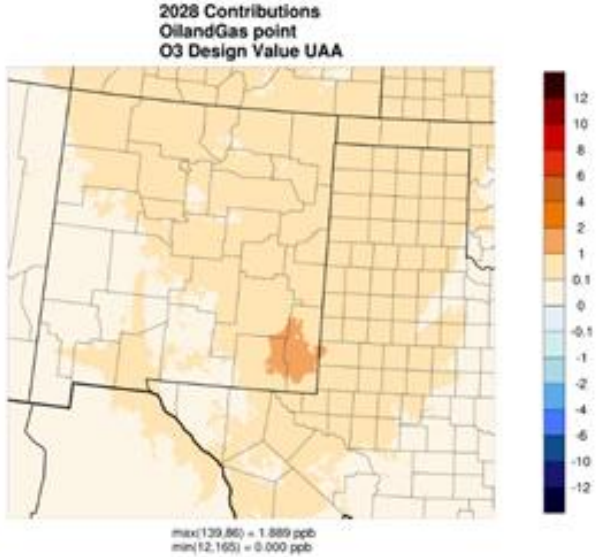
O&G Non-Point

Max = 3.0 ppb



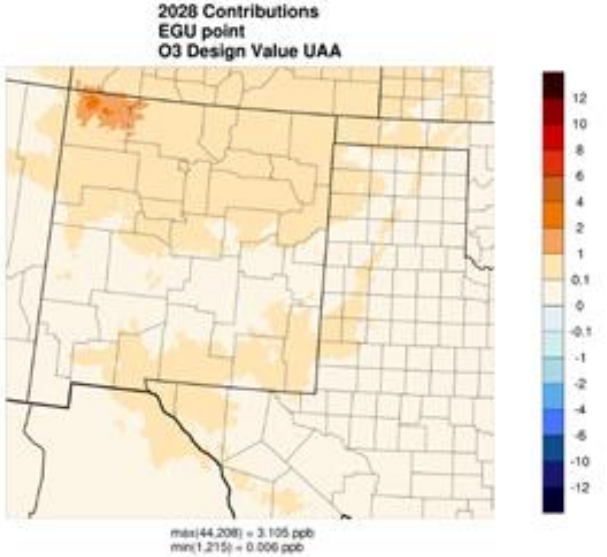
O&G Point

Max = 1.9 ppb



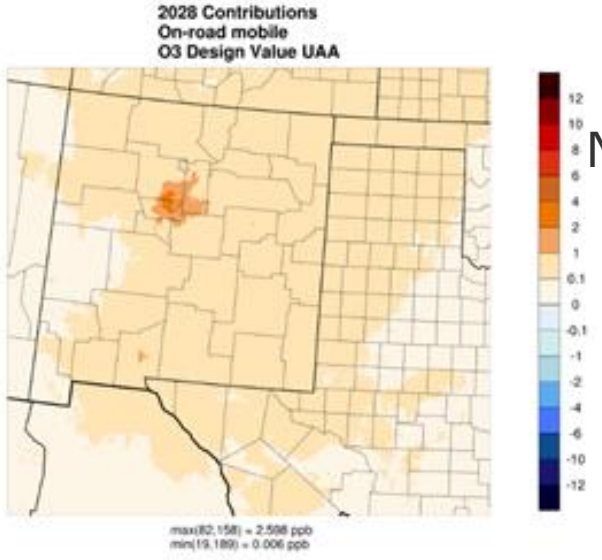
EGU Point

Max = 3.1 ppb



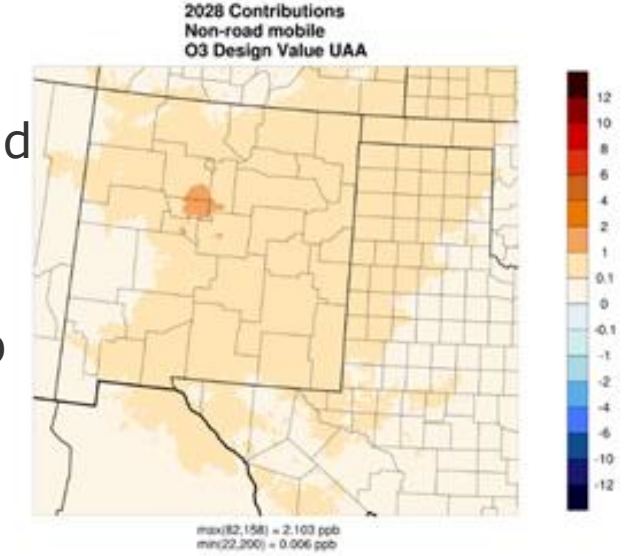
On-Road Mobile

Max = 2.6 ppb



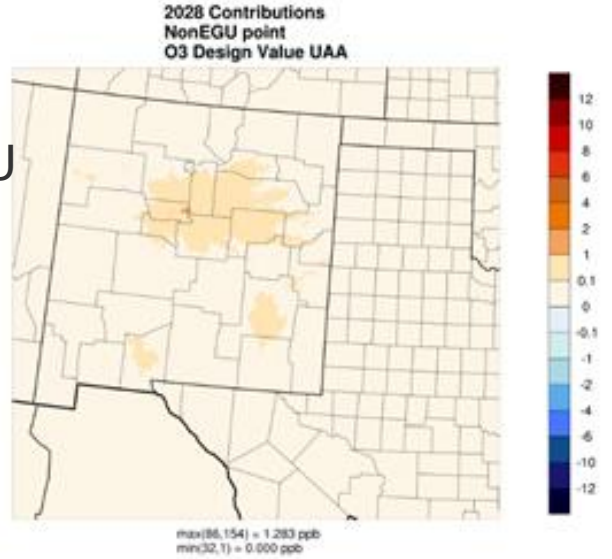
Non-Road Mobile

Max = 2.1 ppb



Non-EGU Point

Max = 1.3 ppb



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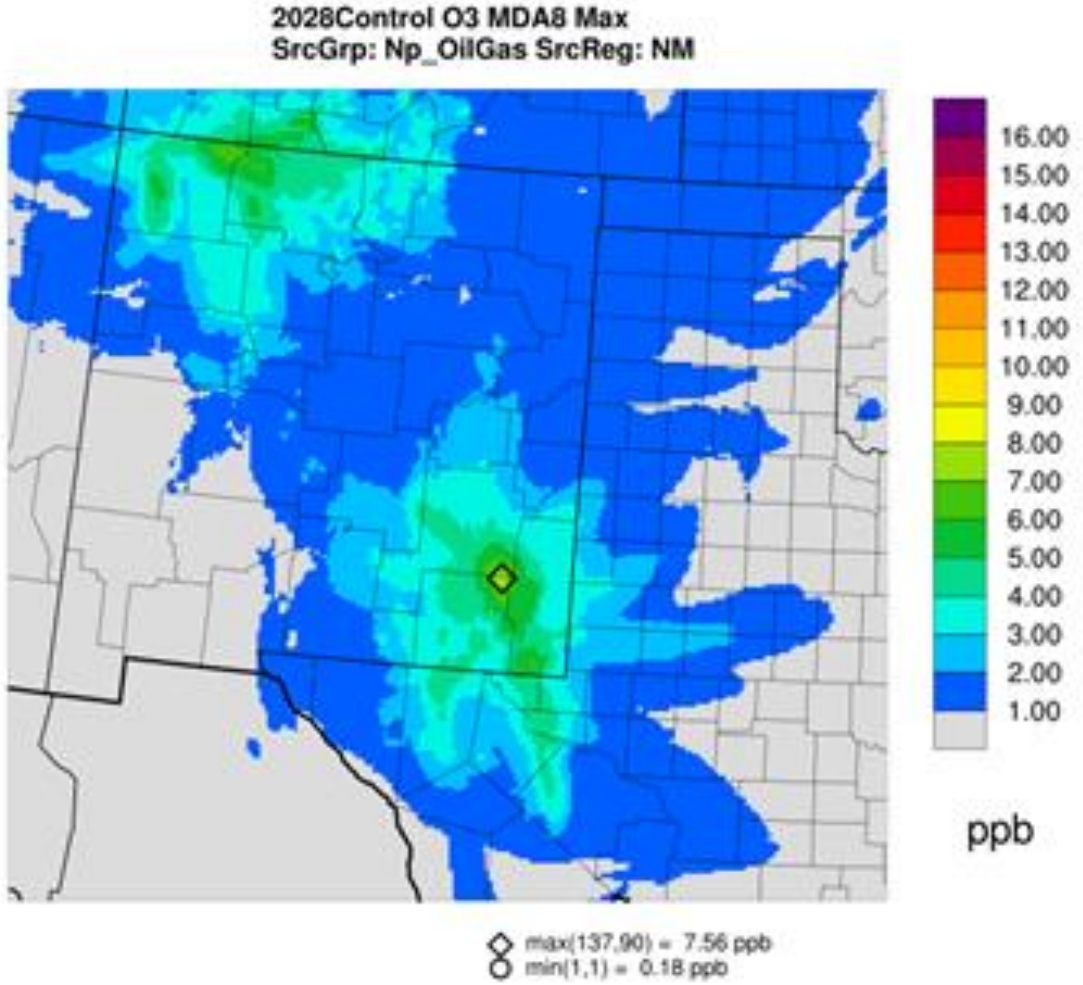
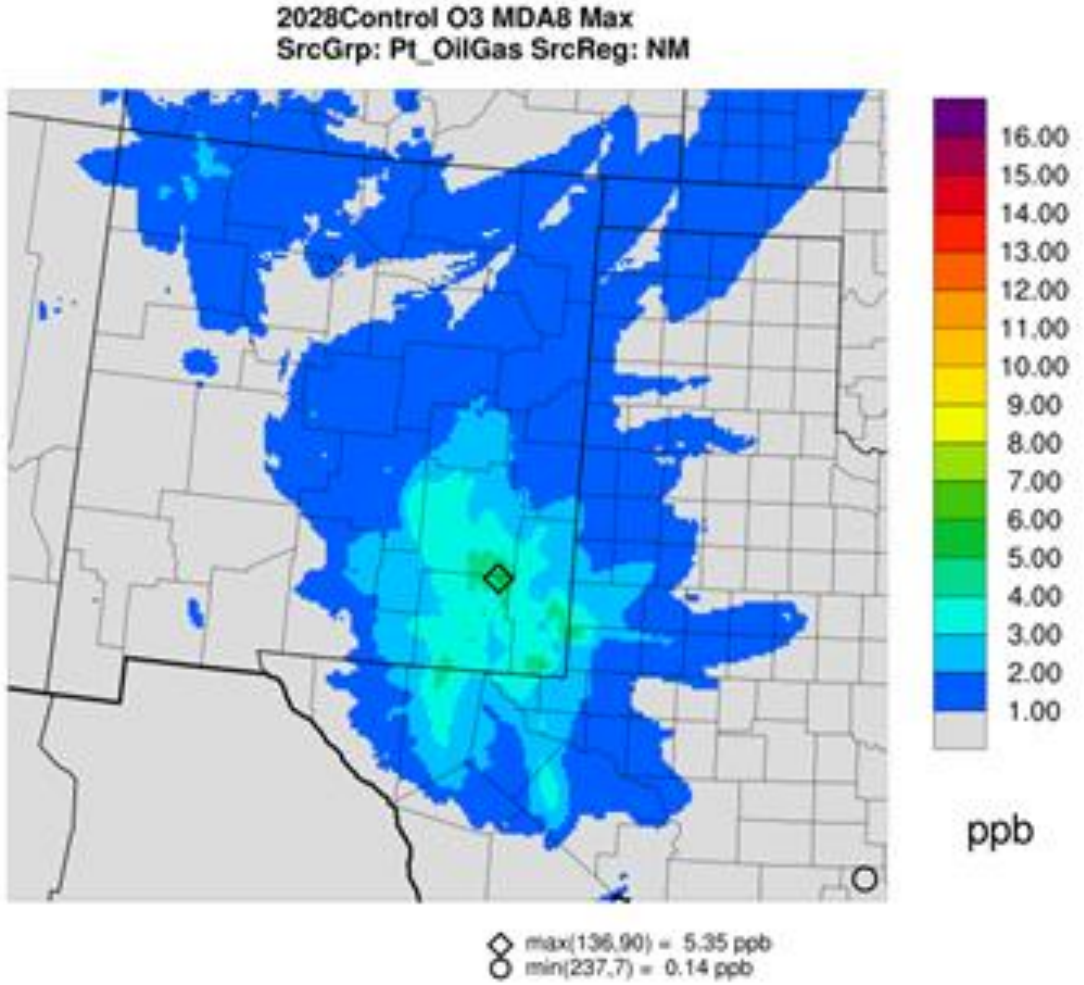
EPISODE MAXIMUM NON-POINT & POINT NM O&G CONTRIBUTION TO DAILY MDA8 OZONE - 2028 O&G CONTROL

- **2028 NM O&G CS NM Non-Point O&G**
  - Max = 7.6 ppb

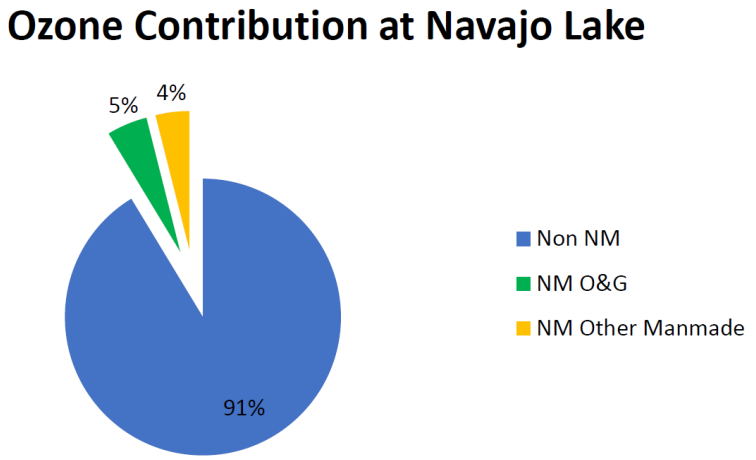


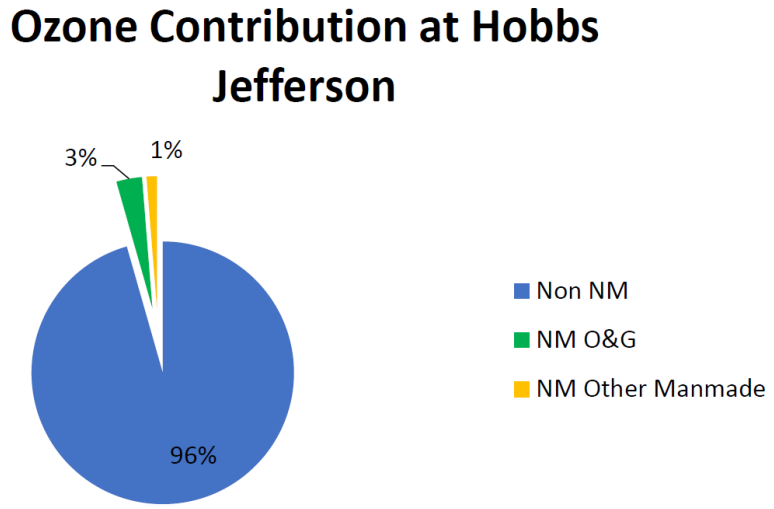
- **2028 NM O&G CS NM Point O&G**
  - Max = 5.4 ppb

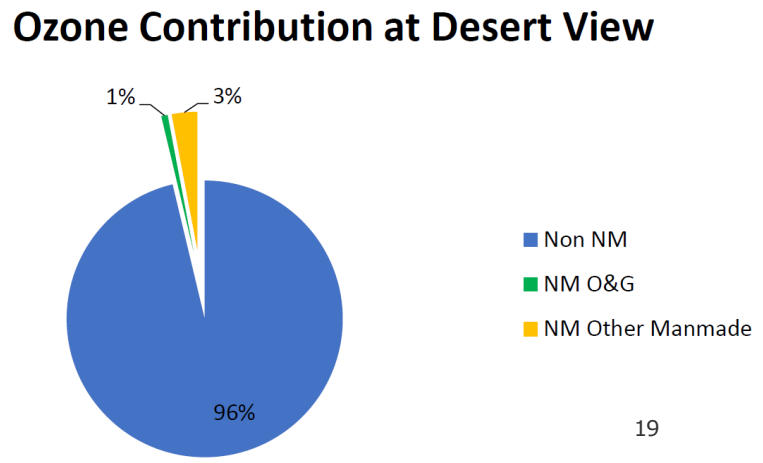


VAST MAJORITY OF THE OZONE IN NEW MEXICO COMES FROM OUTSIDE OF NEW MEXICO OR DUE TO BIOGENIC EMISSIONS

- **Contributions to 2028 ozone DVF from APCA 2028 O&G Control Source Apportionment**
- 91%, 96% and 96% of ozone not due New Mexico anthropogenic emissions at Navajo Lake, Hobbs and Desert View
- O&G ozone contribution to New Mexico total anthropogenic emissions ozone contribution:
  - 55% at Navajo Lake
  - 71% at Hobbs
  - 20% at Desert View







- New Mexico O&G ozone contributions would be even a greater for the 2028 base case before the Part 50 O&G controls were applied

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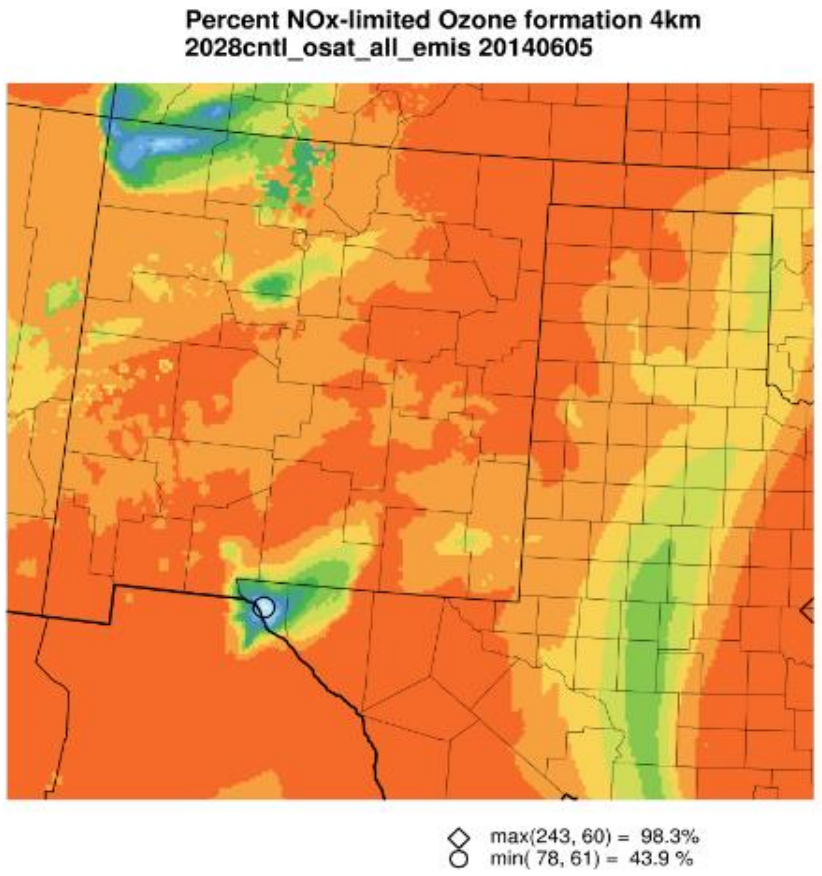
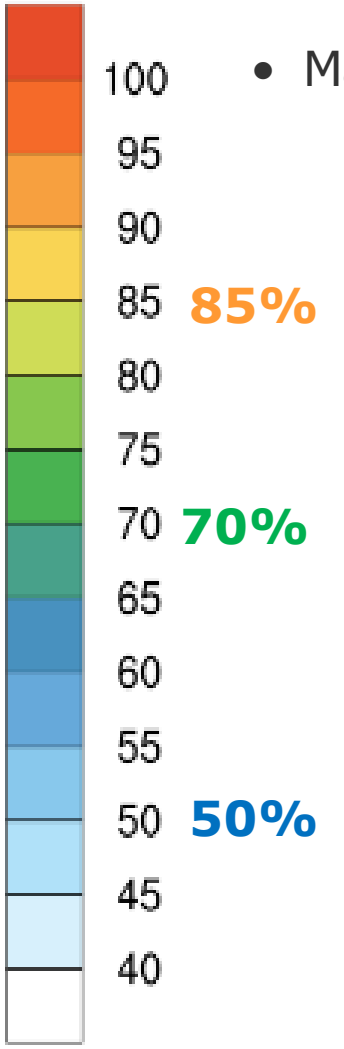
Source: NMOGA Witness Mr. McNally Direct at p. 12-13 Figures D, E & F

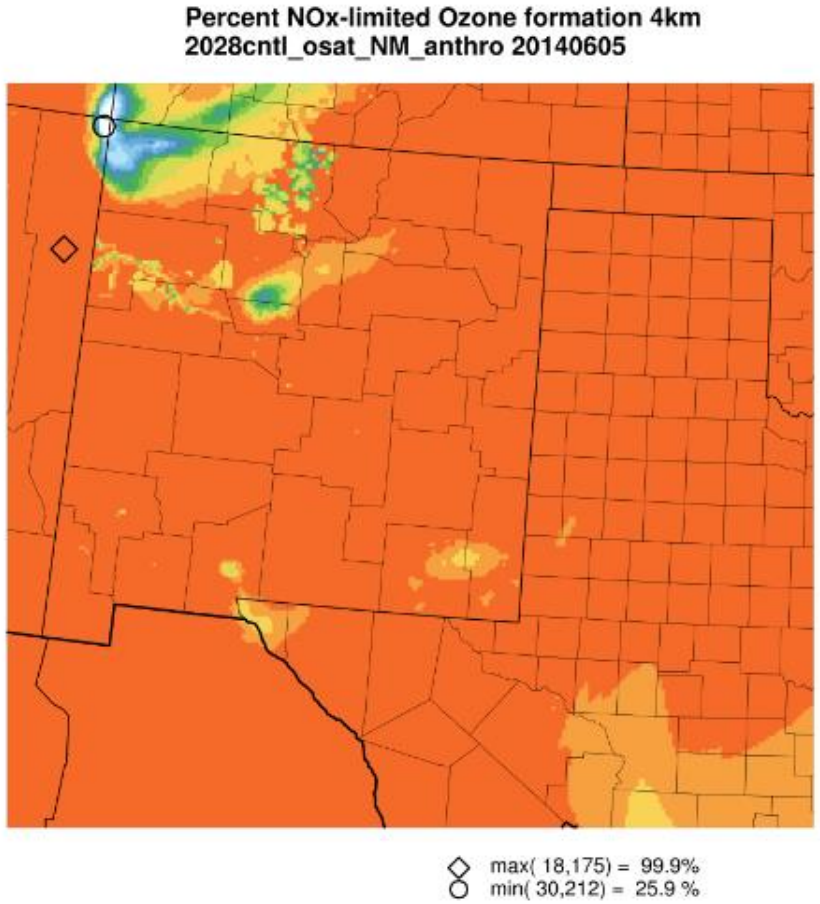
EXAMPLE OSAT PERCENT NOX SENSITIVE OZONE JUNE 5, 2014
2028 O&G CONTROL CASE – MOSTLY NOX SENSITIVE OZONE

- All Anthropogenic Emissions
- Max = 98%; Min =44%





- New Mexico Anthropogenic Emissions
- Max = 100%; Min = 26%



CONCLUSIONS: NM OAI MODELING STUDY

- The New Mexico Part 50 Oil & Gas regulations is estimated to reduced 2028 ozone design values (DVF) at the monitoring sites by as much as -1.5 ppb (Navajo Lake)
  - Across the New Mexico 4-km modeling domain, the highest 2028 DVF reductions is -3.0 ppb
- There are larger reductions in daily MDA8 ozone concentrations due to the 2028 O&G controls
  - Examples given for June 4 (-4.6 ppb) and July 24 (-2.8 ppb)
- 2028 New Mexico Ozone Source Apportionment Modeling Results:
  - Ozone in New Mexico is primarily due to sources outside of New Mexico and biogenic emissions
    - For example, 83% to 99% of projected 2028 O&G Control ozone DVF at New Mexico monitoring sites is due to sources outside of New Mexico and biogenic emissions (i.e., not due to New Mexico anthropogenic emissions)
  - Although modest, New Mexico O&G emissions are a major portion of the New Mexico anthropogenic emissions ozone contribution, even after implementation of the 2028 O&G control strategy:
    - 55% at Navajo Lake; 71% at Hobbs; 20% at Desert View
  - Ozone formation in New Mexico is primarily NOx sensitive, with the exception of northwest New Mexico (San Juan County) that exhibited more VOC sensitive ozone formation conditions

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REBUTTAL SLIDES

MR. BLEWITT STATES THAT THE NM OAI MODELING STUDY AQTSD DID NOT DOCUMENT THE 2014 AND 2028 EMISSIONS

- As clearly stated in the AQTSD, the NM OAI 2014 emissions were based on the WRAP 2014v2 emissions that in turn was based on the EPA 2014 NEIv2 emission inventory. Similarly, except for the 2028 New Mexico O&G emissions that were documented in the AQTSD, the NM OAI study 2028 emissions were based on the WRAP 2028OTBa2 emissions inventory
  - The WRAP 2014v2 and 2028OTBa2 emission inventories were developed for the western states Regional Haze SIPs and are documented on the WRAP website.
  - There are numerous reports, websites and documents/spreadsheets documenting the WRAP 2014v2 and 2028OTBa2 emissions many of which are referenced in the NM OAI study AQTSD.
  - The WRAP 2014v2 and 2028OTBa2 western state Regional Haze SIP emission inventories are some of the most reviewed and documented emission inventories ever developed and the AQTSD and my Direct and Rebuttal Testimonies provide numerous links where the information can be found.

MR. BLEWITT CONCLUDES THAT THE MODELING RESULTS DO NOT SUPPORT THE NEED FOR ADDITIONAL O&G CONTROLS

- Although which sources to control is a policy decision that is up to the State, the technical facts from the modeling and monitoring are as follows:
  - The observed 2015-2019 ozone design values exceed 95% of the 2015 ozone NAAQS at all sites in New Mexico except Santa Fe.
  - The AQCA requires the Board to develop a plan to address elevated ozone levels when they are 95% of the NAAQS, my understanding that the Part 50 O&G ozone precursor controls are part of this plan.
  - Portion of Dona Ana County (Sunland Park) is designed an ozone nonattainment area under the 2015 ozone NAAQS with an attainment year of 2020 that it failed to achieve. Thus, the area may be redesigned as a Moderate ozone nonattainment area with a 2023 attainment year.
  - Even with the implementation of the Part 50 O&G controls in the 2028 base case New Mexico O&G emissions, the New Mexico O&G emissions are still a major part of the New Mexico total anthropogenic emissions. For example, New Mexico O&G contributes 55% and 71% of the New Mexico anthropogenic emissions component of the projected 2028 ozone DVF at Navajo Lake and Hobbs, respectively even after the Part 50 controls have been implemented.

MR. BLEWITT STATES THAT THE NM O&G EMISSIONS DIDN'T INCLUDE PRODUCTION DECLINE SO ARE OVERSTATED

- Production decline was accounted for in the 2014 and 2028 O&G emissions.
  - It is assumed that production-related emissions are highest as the well's production peaks, typically shortly after the well begins production, and decreases over time thereafter (absence of any refracing).
  - The existing O&G emissions has a distribution of wells of different ages in various levels of decline.
  - The future year activity projection factors is for a collection of wells to get an overall activity trend.
  - Thus, the future year 2028 O&G emissions also have a collection of wells in various stages of decline.

MR. BLEWITT STATES THE EFFECTS OF THE O&G VOC AND NOX CONTROLS ON OZONE SHOULD HAVE BEEN SEPARATELY EVALUATED AS THE VOC CONTROLS ARE INEFFECTIVE

- In evaluating emission control strategies for reducing ozone concentrations, the standard practice is to evaluate the combined effects of control strategy VOC and NOx emission reductions on ozone concentrations.
- Some control measures obtain both VOC and NOx emission reductions (e.g., reducing hours of operations) so obtaining separate ozone contributions doesn’t make sense.
- That being said, the NM OAI modeling suggests that ozone formation is more NOx sensitive than VOC sensitive and a majority of the ozone reductions due to the New Mexico O&G emission reduction strategy is likely due to NOx emission reductions.

UNCERTAINTIES IN MR. MCNALLY ATTEMPT TO SPLIT O&G OZONE CONTRIBUTIONS BETWEEN VOC AND NOX EMISSIONS

- Given that the modeling suggests that ozone formation in New Mexico is mainly NOx sensitive, I do not disagree with Mr. McNally's conclusions that O&G NOx emissions contributes more ozone than the O&G VOC emissions. But his attempt to quantify the separate ozone contributions of New Mexico O&G VOC and NOx emissions using my 2028 O&G control strategy APCA source sector ozone source apportionment results in Table D of his Direct Testimony has numerous uncertainties:
  - APCA source apportionment was performed for the 2028 O&G control strategy after the O&G has been controlled and there were over twice as many tons of VOC reduced than NOx so the split of ozone contributions between O&G VOC and NOx emissions will be different in the 2028 base case.
  - The APCA ozone source apportionment tool overrides the VOC/NOx ozone formation sensitivity calculations in some cases, and he should have used the OSAT version of the ozone source apportionment tool
  - Mr. McNally only analyzes the O&G VOC/NOx sensitivity using 2028 ozone DVFs based on the relative modeling results averaged over 10 days. The level of VOC/NOx ozone sensitivity had a lot of day-to-day variations, so he likely missed days with higher O&G VOC ozone contributions.

EFFECTS OF NOT INCLUDING NOX EMISSION INCREASES IN SOME VOC O&G CONTROL MEASURES

- Mr. McNally suggests that not including NOx emission increases associated with some of the VOC control measures in the Part 50 oil and gas regulation 2028 O&G control strategy controls (e.g., flares) "would reduce any ozone benefit from the VOC controls and could worsen the ozone air quality" (McNally Direct at p. 16).
  - ERG provided an estimate of the increase in NOx emissions due to the VOC controls and I estimated that it would have no material effect on the ozone modeling results.
    - ERG estimated that NOx emissions would increase by 67 tons per year (TPY) due to the Part 50 VOC control measures.
    - The maximum decrease in 2028 ozone DVFs due to the implementation of the 46,296 TPY NOx emissions reductions between the 2028 base and 2028 O&G control strategy was -1.5 ppb at Navajo Lake.
    - Thus, a maximum order of magnitude ozone increase due to adding 67 TPY NOx emissions would be in the thousandth (0.001) of a ppb (0.002 = 1.5 x (67/46,296).
    - As Mr. McNally and I both reported the ozone modeling results to the nearest tenth (0.1) of a ppb, the addition of 67 TPY NOx emissions would not change the modeling results.
    - Even if the NOx emission increase was 10 times higher than estimated by ERG (670 TPY), they would still have no material effect on the ozone modeling results.